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## SOME EXPERIMENTS ON THE ASSOCIATIVE POWER OF SMELLS.

By E. M. BOLGER and E. B. TITCHENER.

This brief communication may be regarded as a foot-note to the study published under the same title in 1905 by the Misses A. Heywood and H. A. Vortriede.<sup>1</sup> The object of that study was to make a laboratory test of the observation, not uncommon in everyday life, that odors possess a remarkable power to revive past experiences. The method followed was, in general, that used by Professor Calkins in her work on association. Combined series of odors and pictures, and of odors and colored squares, were presented to the observer, and the series of odors repeated later in a different order; the percentages of correct associations were then noted. The results were checked by those of series in which the odors were replaced by nonsense syllables (auditory stimulus). The authors conclude that "the odors have no superiority in suggestive or associative power over the nonsense syllables."

It seemed to us that it was worth while to repeat these observations. We hoped, on the one hand, to go a little more deeply into the qualitative analysis of association, and on the other to get suggestions for an improved method of attacking the problem. Both efforts were unsuccessful. The Calkins method is, without any doubt, too crude for analytical work, and the change that we ourselves introduced led only to negative results.

We first repeated the Vassar experiments, with two minor variations. The time of exposure was reduced from 15 to 5 sec., on the ground that a time of 15 sec. might give opportunity for wandering of the attention. Secondly, while we employed the 6-term series with one observer, we raised the number of terms to 12 for two other observers: it was possible, we thought, that the odors might show their superiority under the more complicated conditions. The results need not be given in detail. They resembled those obtained in the Vassar laboratory, except that the odors showed at a still greater disadvantage. It was clear that, under the conditions of these ex-

<sup>1</sup> Minor Studies from the Psychological Laboratory of Vassar College, communicated by M. F. Washburn, i. This *Journal*, XVI, 1905, 527; XVII, 1906, 148.

periments, an exposure time of 5 sec. does not allow an odor to impress itself upon the attention.

We then had recourse to a change of method. The odors that in everyday life prove effective for recall are diffused odors; the "smell of box" that "recalls a garden frequented in childhood" was probably dominant over a wide area of the garden, and was thus associated to a varied and complex visual situation. We tried to reproduce this condition by suffusing our pictures with odors, instead of presenting the odors separately in phials. A careful selection was made of 50 picture post-cards. Envelopes, filled with cotton wool, were pasted to the backs of the cards; and the wool was saturated with the odorous stimulus before the experimental series began. The odors were distributed, as evenly as possible, over Zwaardemaker's nine classes. Every care was taken to keep the stimuli from mixing or becoming contaminated during the course of the tests. The cards were arranged in 5 series of 10 members, and the experiments were made with two observers, both of whom had taken part in the previous work. The time of exposure was 10 sec. for the one and 15 sec. for the other observer.

The stimulus in the combined series was now a scented picture; in the test series, the scent alone. Nevertheless, although the conditions were by so much nearer the conditions of everyday life, the outcome was still negative. The odors were no more effective than nonsense syllables (auditory stimulus), and were distinctly less effective than simple geometrical figures drawn with ink in a corner of the pictures. The result was the same for both observers, and therefore for both exposure times.

The next step in method would be, perhaps, to make up combined series of a mixed sort,—one or two of the pictures being scented, and the rest paired with nonsense syllables or colors or geometrical forms. We were, however, compelled to break off the investigation at this point.